IIT Mandi
Proposal for a New course

Course Number : CE 604

Course Name : Theory of Plasticity

Credits : 3

Distribution : 2-1-0-3

Intended for : P.G. (M.Tech Structure, Design, etc., M.Tech by Research, and Ph.D.)

Prerequisites : Strength of Materials and Structures, Structural Analysis, Theory of elasticity, advanced solid mechanics

1. **Preamble: This course highlights the limitations of the results given by the Strength of material and theory of elasticity approach and equally important for the postgraduate students in Civil, Mechanical and Aerospace engineering as well as for engineers to understand the complete behavior of solids under applied loads. The course starts with the introduction to plasticity, assumptions and its applications to the different fields of engineering. Later on, the concept of the analysis of stresses and strains will be developed and applied to practical problems.**

2. Course Modules with quantitative lecture hours:

    1. **Introduction:** Fundamental principles of plasticity, Basic laws of plasticity, Index notations. **(4)**
    2. **Criteria of yielding;** Maximum stress theory, Maximum strain theory, maximum shear theory, maximum strain energy theory, Distortion energy theory, Mohr's theory of yielding, Yielding surfaces. **(6)**
    3. **Plastic stress strain relations:** Strain relations, Distinction between Elastic and Plastic Stress-Strain Relations, Plastic work, Derivation of Plastic Stress- strain relations. **(6)**
    4. **Elastoplastic Problems of Spheres and Cylinders:** General relations, thick hollow sphere with internal pressure and thermal loading, Hollow sphere- Spread of Plastic Zone, Residual Stresses and Strain hardening material. **(8)**
    5. **Plane problems in plasticity:** Beltrami- Michell equation, Plastic Bending of Plates, Deflection of Circular Plates, Plane Strain Analogy for Plate Bending, Yield Line theory for Plates, Axis symmetric case, General theorems of plasticity, Drucker's postulates, Integration of Plasticity Equation. **(8)**
    6. **The Torsion problem:** Torsion of Prismatic Bar, General relations, elasticity solutions, perfect plasticity, elastoplastic torsion with strain hardening, bar with rectangular cross-section, bar with circular cross-section. **(6)**
    7. Slip-Line Field and limit analysis. **(4)**

3. Text books:

a. J. Chakrabarty, "Applied Plasticity, Second Edition", Springer New York Dordrecht Heidelberg London.
b. Alexander Mendelson, "PLASTICITY: Theory and Application", The Macmillan Company, New York.
c. Jacob Lubliner, "Plasticity Theory", Courier Corporation, 2008.

4. Reference books:

1) R. M. Jones, "Deformation theory of plasticity". Bull Ridge Publishing, USA.
2) Akhatar S khan Sujain Huang , "Continuum Theory of Plasticty", John Wiley and sons. INC.
3) L.M. Kachanov, "Fundamentals Theory of Plasticty", Dover Publication. INC.
4) Jacob Lubliner, "Plasticity theory", Dover Publication. INC.

5. Similarity with the existing courses:
(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.	Course Code	Similarity Content	Approx. % of Content
1.	None	None	None

6. Justification of new course proposal if cumulative similarity content is >30%: N/A